

REMARKS

35 U.S.C. § 102

Claims 24-29, 31, and 33-34 have been rejected as allegedly anticipated by Beernick et al. (U.S. Patent No. 5,717,707). Applicants request that this rejection be withdrawn because Beernick does not disclose or suggest the subject matter of independent claim 24.

Independent claim 24 recites a ridge waveguide semiconductor laser having a first cladding layer with a ridge and an active layer with a defined gain region and reduced conductivity regions flanking the defined gain region. The ridge has a first width at the bottom of the ridge and the defined gain region has a second width greater than the first width.

Beernick does not disclose or suggest a ridge waveguide semiconductor laser. To the contrary, Beernick relates to buried heterostructure lasers (see generally, col. 1:49 – col. 2:3; col. 4:31-41; col. 8:10-12), the fabrication of which generally requires at least one overgrowth step and/or diffusion step to confine the active region of the laser (see col. 4:66 – 5:38). The extra overgrowth and diffusion steps used to create a buried heterostructure permit the fabrication of complicated buried laser structures, such as those disclosed in Beernick for guiding the current injected into the active region of the buried heterostructure laser and for guiding the light emitted from the buried heterostructure laser. The buried heterostructures disclosed in Beernick all have an active region and a top cladding that are laterally confined by semiconductor material to provide an index-guided waveguide structure. In the heterostructures disclosed by Beernick, laser light generated in the active region is guided by lower index of refraction material (created by impurity-induced layer disordering) located on the side of the active region and top cladding. The top of the top cladding does not rise significantly above the level of the rest of the semiconductor layer stack, and thus does not form a “ridge” as recited in applicants’ claim 24.

In particular, claim 24 recites “[a] ridge waveguide semiconductor laser diode,” which includes a first cladding layer having a ridge with a first width at a bottom of the ridge, a second cladding layer, and an active layer disposed between the first and second cladding layers. Furthermore, “ridge waveguide lasers” are known to those of skill in the art to be significantly different from Beernick’s heterostructure lasers. See e.g., Semiconductor Lasers, Agrawal and Dutta, pp. 197 - 212 (Kulwer Academic Publishers, Norwell, Mass. 1993) (Exhibit A). As

described and illustrated in section 5.4 and Fig. 5.17 of Semiconductor Lasers, ridge waveguide structures are created by epitaxially growing a semiconductor layer stack that is then “etched to form a ridge.” Id. at 197. Thus, “[t]he planar active layer of a ridge waveguide laser extends beyond the ridge . . .” id. at 198. The overlap of the laser mode with the dielectric material on top of the semiconductor stack to the side of the ridge “introduces an effective lateral index step . . . [, t]he magnitude [of which] is determined by the thickness of the waveguide layer.” Id. at 198-99. This is quite different from heterostructure laser, as described and illustrated in section 5.5 and Fig. 5.18 of Semiconductor Lasers. In buried heterostructure lasers “the active region is buried in higher band-gap layers (e.g., InP) on all sides.” Id. at 201. Because the active region is buried, “the lasing characteristics of buried-heterostructure lasers are primarily determined by the rectangular waveguide that confines the mode inside the buried active region.” Id. In summary, ridge waveguide lasers and buried heterostructure lasers are well known in the art as fundamentally different structures.

For at least these reasons, applicants respectfully request allowance of claim 24. Claims 25-34 depend from claim 24 and are allowable for at least the reasons that claim 24 is allowable and for containing allowable subject matter in their own right. Specifically, claim 31 recites that “the reduced conductivity regions are implanted with high-energy ions.” Beernick does not disclose or suggest reduced conductivity regions flanking the active region that are implanted with high-energy ions. If the Office maintains this rejection, applicants respectfully request the Examiner to point to where Beernick discloses the implantation of high-energy ions into reduced conductivity regions flanking the active region.

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Claim 30 has been rejected as allegedly obvious over Beernick in view of well-known art. Applicants respectfully request allowance of claim 30. Claim 30 depends from claim 24 and is allowable for at least the reasons that claim 24 is allowable.

Claim 32 has been rejected as allegedly obvious over Beernick in view of Nagai et al. (U.S. Patent No. 5,469,457). Applicants respectfully request allowance of claim 32. Claim 32 depends from claim 24 and is allowable for at least the reasons that claim 24.